Northeast Utilities System

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December 13, 1996

Docket Nos. 50-336

B16065

Re: 10CFR2.201

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Millstone Unit No. 2
Response to Request For Additional Information
Regarding TAC No. M85571
Thermo-Lag Related Ampacity Derating Issues

The purpose of this letter is for Northeast Nuclear Energy Company (NNECO) to provide additional information concerning Thermo-Lag Related Ampacity Derating Issues as requested by the Staff in the letter of August 12, 1996.[1] The initial response to each of the three questions presented by the Staff in the letter of August 12, 1996, as well as the response to additional information requested by the Staff in the teleconference held between the Staff and NNECO on September 5, 1996, was presented in the letter of October 3, 1996.[2] At that time the Thermo-Lag ampacity calculations had not been completed and NNECO committed to provide the Staff with updated information after completion of the calculations. The Thermo-Lag ampacity calculation for Millstone Unit No. 2 has now been completed. The updated information relating to the Staff request for additional information is contained in Attachment 1.

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1 Phillip F. McKee to Ted Feigenbaum, "Request for Additional Information Regarding Thermo-Lag Related Ampacity Derating Issues For Millstone Units 1 and 2 (TAC Nos. M85570 and M85571)", dated August 12, 1996.

2 T. C. Feigenbaum to U. S. Nuclear Regulatory Commission, "Millstone Unit Nos. 1 and 2 Response to Request for Additional Information Regarding TAC Nos. M85570 and M85571, Thermo-Lag Related Ampacity Derating Issues", dated October 3, 1996.

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The completed ampacity derating calculation, "96-ENG-01528E2, Ampacity Derating of Cables Due to Thermo-Lag," is contained in Attachment 2.

The following are NNECO's commitments identified within this letter. All other statements contained within this letter are for information only.

B16065-01 NNECO will notify the Staff if any of the cables that do not meet their design ampacity rating are determined to have been degraded by operation above rated temperature.

B16065-02 Alternate means of Appendix R compliance are being evaluated to eliminate the Thermo-Lag installations of concern. This evaluation will be completed by July 1, 1997.

If you have any additional questions concerning this submittal, please contact Mr. Richard T. Laudenat at (860) 444-5248.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

M.L. Bowling
Recovery Officer, Millstone Unit No. 2

Attachments

cc: W.D. Travers, Director of Special Projects
H. J. Miller, Region I Administrator
D. G. McDonald, Jr., NRC Project Manager, Millstone Unit No. 2
Senior Resident Inspector, Millstone Unit No. 2

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Attachment 1

Millstone Unit No. 2

Response to Request For Additional Information

Regarding TAC No. M85571

Thermo-Lag Related Ampacity Derating Issues

December 1996

The Staff, in conjunction with its contractor, Sandia National Laboratories (SNL), has completed the preliminary NNECO's submittal and the following questions require clarification by NNECO:

Question 1:

NNECO should confirm that all fire barrier construction for the subject configuration(s) are representative of the barrier construction used in the Comanche Peak Steam Electric Station (CPSES), Unit 2 ampacity derating tests.

Answer 1:

Calculation 96-ENG-01528E2, "Ampacity Derating of Cables Due to Thermo-Lag," establishes the derated ampacity values for 'l cables protected by Thermo-Lag within Millstone Unit No. 2. Using standard heat transfer equations, the different configurations were modeled and the output compared to the CPSES test results. The comparison showed that the model conservatively predicts the surface temperature of the wrap. Ampacity Correction Factors (ACF) were then determined from the different models as tabulated below:

ACF

Cable Tray	0.60
Conduit	0.77

Question 2:

NNECO should verify whether the installed Thermo-Lag fire barriers are single (one 1" thick) or double (two 1/2" thick) layer systems. The Thermo-Lag fire barrier system tested at CPSES 2 was a single layer system. If a double layer system is used at Millstone Units 1 and 2, then the scaling methodology used on the TU test results is invalid and may prove to be non-conservative for application. If the above case proves true, NNECO should provide additional justification for the extrapolation of the single layer test results to a double layer system or provide an alternative basis for ampacity derating determination and analysis of the installed Thermo-Lag configuration.

Answer 2:

Based on the information contained in references 1, 2, and 3,[3] the installed Thermo-Lag fire barriers at Millstone Unit Nos. 1 and 2 are single layer systems with a 1" nominal thickness. As discussed in Answer 3 below, a scaling factor was not used in the final calculation method.

Question 3:

For the air drop example calculation provided in the NNECO submittal dated November 3, 1995, NNECO identified that the subject cable is nominally overloaded and based its acceptability on emergency overload temperature ratings. The staff requests that NNECO address the following points and provide specific quantitative assessments of ampacity derating acceptability for the Thermo-Lag installed fire barrier:

- The basis for the assumed temperature limits must be documented. That is, the licensee should cite the source of these overload ratings and establish the applicability of those values to the cables in use at Millstone Units 1 and 2. (Note that NEC does not address overload ratings but that various ICEA documents do.)

- If NNECO argues that non-continuous operation above the rated temperature of the insulation is acceptable, then one critical aspect of this argument, which must be addressed, is the impact of such operation on the anticipated cable operating life. This aspect should be addressed through Quantitative life impact assessments in a context similar to that applied to the Equipment Qualification Program. Even relatively short periods of operation above the nominal rated temperature can lead to significant loss of cable life. (Note that this type of analysis must consider the full range of temperature cycling behavior, including normal aging at the prevailing ambient condition of 40°C and the effects of mutual heating from other nearby cables where applicable.) At the least, an aging analysis should be provided, which conservatively bounds the worst case anticipated operating conditions.

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[3]
1) Haddam Neck Millstone, Nuclear Power Station Unit Nos.1, 2, and 3, Response to Request for Additional Information Regarding Generic Letter 92-08, "Thermo-Lag 330-1 Fire Barriers Pursuant to 10 CFR 50.54(f)", dated February 11, 1994.

2) Northeast Utilities Thermal Lag Installation Specifications SP-ME-596 Rev. 1 and SP-ME-641 Rev 0.

3) Northeast Utilities Purchase Order 853690 dated August 21, 1986.

- By their very nature, emergency overload ratings are intended to provide for rarely occurring and unexpected events in which a circuit might be overloaded. For example, the IPCEA P-46-246 tables state that "Operation at the overload temperatures...shall not exceed 100 hours per year. Such 100-hour overload periods shall not exceed five." The use of emergency temperature overload ratings as the basis for acceptance of normal anticipated cable operating conditions may be inappropriate. At the least, this represents a fundamental departure from accepted ampacity assessment approaches, and therefore, further justification of this treatment is required.

Answer 3:

Calculation 96-ENG-01528E2, "Ampacity Derating of Cables Due to Thermo-Lag," establishes the derated ampacity values for all cables protected by Thermo-Lag within Millstone Unit No. 2. Using standard heat transfer equations, the different configurations were modeled and the output compared to the CPSES test results. The comparison showed that the model conservatively predicts the surface temperature of the wrap. Ampacity Correction Factors (ACF) were then determined from the different models as tabulated below:

ACF

Cable Tray	0.60
Conduit	0.77

All initial cable ampacities are based on a design ambient of 50°C and alloy coating for copper conductors. For conduit installations, the ampacity was derated based on the number of conductors in the conduit and the grouping factor for the conduits. The conduit model was also used for cables not in conduit but protected by conduit wrap (e.g., air drops). This is conservative since the conduit barrier is not present. For cable trays, the ampacity was determined based on installation method (random fill or uniform spacing) using industry standards. This value was then multiplied by the ACF to determine the maximum allowable ampacity (I_{max}). The cable design load was then compared to I_{max} to determine acceptability. Cable design loads were conservatively determined using the appropriate multiplication factors (e.g. 1.25 for motors, 1.2 for transformers and 1.1 for others).

Summary of Results

Using the above approach, with the exception of six (6) cables, all fire wrapped cables were shown to meet their design basis ampacity requirements with margin. The following cables do not meet their design ampacity rating:

- The crossties between 4.16kv emergency bus 24E (swing bus) and emergency diesel busses 24C and 24D (2 separate cables). These cables have a normal and emergency design requirement. The normal ampacity requirement is below the calculated I_{max}. The maximum design load would

only occur as a result of a Station Blackout, Appendix R fire, or use as the alternate offsite source. None of these events have occurred at Millstone Unit No. 2 since the installation of the Thermo-Lag.

- Facility 1 and Facility 2 power supply feeders to the "B" (swing) Charging Pump and feeders to the "A" and "C" charging pumps (total of 4 cables).

An Adverse Condition Report (ACR) M2-96-0757 was prepared to document the above deficient design condition. The cables are currently considered operable based on actual ambient temperature (<40°C) and loading conditions. Quantitative life impact assessment similar to that applied to the Equipment Qualification Program is ongoing to evaluate potential cable insulation degradation. NNECO will notify the Staff if the cables are determined to have been degraded by operation above rated temperature.

Alternate means of Appendix R compliance are being evaluated to eliminate the Thermo-Lag installations of concern. This evaluation will be completed by July 1, 1997.

Additional Questions:

The Request for Additional Information was further clarified in the conference call of September 5, 1996, to include the following additional items: (1)consideration of the total number of conductors in derating cables in conduit, (2) recognizing the impact of service factor of motors on cable ampacity, (3) derating cable ampacity of cables in overfilled conduits, and (4) alloy coating of copper conductors effect on ampacity.

Answer:

1) For conduit installations, the ampacity was derated based on the number of conductors in the conduit and the grouping factor for the conduits.

2) Cable design loads were determined using the following multiplication factors:

   - 1.25 for motors,

   - 1.2 for transformers, and

   - 1.1 for others.

3) As noted in item (1), the ampacity of conductors in the conduit is based on the number of conductors in the conduit. Industry standards do not require any additional derating based on percent fill.

4) All initial cable ampacities are based on a design ambient of 50°C and alloy coating for copper conductors.

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Attachment 2

Millstone Unit No. 2

Response to Request For Additional Information

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96-ENG-01528E2, Ampacity Derating of Cables Due to Thermo-Lag

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